CONTROL PANEL FOR FUEL OIL PUMP SETS:

PROVIDE A CONTROL PANEL FOR EACH NEW DUPLEX FUEL OIL PUMP SETS

DIGITAL CONTROL PANEL FOR EACH DUPLEX PUMP SET. THE CONTROL PANEL PROVIDES AUTOMATIC SEQUENCING OF THE DUPLEX PUMPS VIA COMMANDS FROM THE FIVE (5) GENERATORS. THIS PANEL ALSO FUNCTIONS AS A MODBUS NETWORK SLAVE TO THE BUILDING MANAGEMENT SYSTEM FOR THE PURPOSE OF TRANSMITTING SYSTEM STATUS AND ALARM MESSAGES TO THE BMS.

CONTROL PANEL SHALL INCLUDE THE FOLLOWING:

1. UL508A LISTED INDUSTRIAL CONTROL PANEL. NEMA12 POWDER COATED STEEL, WALL MOUNTABLE, HINGED, LOCKABLE AND GASKETED ACCESS DOOR.
2. PLC BASED CONTROL SYSTEM. PLC TO BE AUTOMATION DIRECT
   a. PLC BASED CONTROL SYSTEM, DUAL PLC FOR REDUNDANCY
   b. OPERATOR INTERFACE
   c. MODBUS COMMUNICATION PROTOCOL OVER RS-485
   d. PLC INPUT CIRCUIT BREAKER WITH TRIPPED INDICATOR
   e. PLC FAIL INDICATORS
   f. PLC SELECTOR SWITCH (A/B)
   g. UPON PLC FAILURE CONTROLS SHALL GENERATE ALARM AND AUTOMATICALLY SWITCH TO BACK-UP PLC.
3. DUAL SOURCE POWER SUPPLY. SOURCES IDENTIFIED ON THE ELECTRICAL PLANS
   a. INLET FLANGED DISCONNECT SWITCHES
   b. POWER SOURCE TRANSFER RELAY
   c. INPUT CIRCUIT BREAKERS WITH TRIPPED INDICATORS
   d. SOURCE AVAILABLE INDICATOR
   e. SOURCE CONNECTED INDICATORS
4. ALARM AUDIBLE SIGNAL WITH SILENCE PUSHBUTTON
5. INDICATOR PRESS-TO-TEST PUSHBUTTON AND INDICATOR
6. PUMP CONTROL OF DUPLEX PUMPS (2 PUMPS FOR EACH PUMP SET)
   a. PUMP HOA SWITCH (2) WITH NOT-IN-AUTO INDICATOR
   b. PUMP RUNNING INDICATOR (2)
   c. PUMP FAIL INDICATOR (2)
   a. TWO (2) MOTOR STARTERS, DEFINITE PURPOSE TYPE, 3-PHASE, ACROSS-THE-LINE, NON-REVERSING STARTERS, INCLUDING PUMP MOTOR CIRCUIT BREAKER AND 3-PHASE OVERLOAD RELAY.
   d. AUTOMATIC PUMP DUPLEX CONTROL AND SEQUENCING VIA INPUTS FROM GENERATORS
8. DUPLEX PUMP CONTROL
   a. AUTOMATIC PUMP SEQUENCING UNDER DEMAND CONTROL OF GENERATORS.
   b. AUTOMATIC ROTATION OF PUMPS
   c. LOSS OF FLOW ALARM INTEGRATION TO ACTIVATE OFFLINE PUMP
9. ALL CONTROL SWITCHES, PUSHBUTTON AND INDICATORS ARE 22MM OIL-TIGHT TYPE. ALL INDICATORS ARE 22MM LED
10. CONTROL POWER TRANSFORMERS, PROVIDE CIRCUIT BREAKER OVER CURRENT PROTECTION FOR PRIMARY AND SECONDARY
11. ALL INDICATORS NOTED ABOVE ARE REPEATED AS MODBUS OUTPUTS TO THE COMMUNICATIONS BUS
12. ALL FIELD WIRING IS TO NUMBERED TERMINAL STRIPS LOCATED IN FIELD WIRING JUNCTION BOXES
13. ALL WIRING IS RUN IN RACEWAYS AND NUMBERED BOTH ENDS
14. CONTROL PANEL SHALL INCLUDE 480 VOLT TO LOW VOLTAGE TRANSFORMER.
15. CONTROL PANEL SHALL INCLUDE A LCD INTERFACE SCREEN WHICH DISPLAYS ALARMS AND PROVIDES INFORMATION ON PUMP OPERATION.
    a. PROVIDE A MEANS TO MANUALLY SILENCE THE ALARM.
16. CONTROL PANEL AUDIBLE ALARM.

VA Generator Fuel Oil Calaculations (FOR REFERENCE ONLY)

50% Fill Level

	Generator #1	Generator #2	Generator #3	Generator #4	Generator #5 (Energy Center)
Generator					
Size (KW)	1000 KW	1000 KW	1500 KW	1500 KW	2000 KW
Fuel Consumption 100% Load (GPH)	72.1	72.1	104.6	104.6	138
Fuel Consumption 100% Load (GPM)	1.2	1.2	1.7	1.7	2.3
Fuel Consumption 75% Load (GPH)	54.4	54.4	82	82	107.5
Fuel Consumption 75% Load (GPM)	0.9	0.9	1.4	1.4	1.8

Day Tank									
Day Tank Volume (Gallons)	60	**60**	60	**60**	60	**60**	60	**60**	660
Full Day Tank-Pump Off (90% Full) (Gallons)	54	**54**	54	**54**	54	**54**	54	**54**	594
Transfer Pump On (50% Full) (Gallons)	30	**30**	30	**30**	30	**30**	30	**30**	330
Low Alarm-Open second solinoid (25% Full) (Gallons)	15	**15**	15	**15**	15	**15**	15	**15**	165
Low Alarm-Shut Engine Off (10% Full) (Gallons)	6	**6**	6	**6**	6	**6**	6	**6**	66

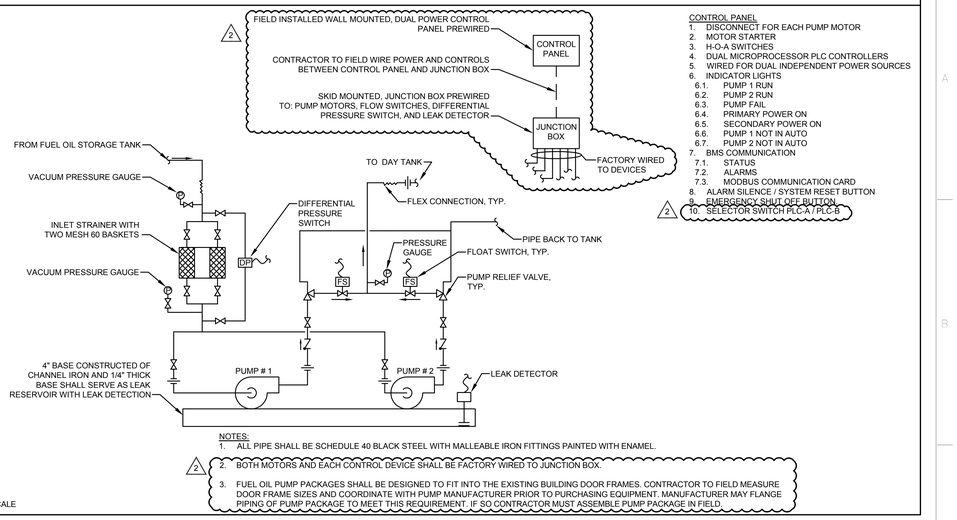
FTP-A - Normal Pump Cycle (90%-50%) (Gallons)		24		24		24		24	
FTP-B - Normal Pump Cycle (90%-50%) (Gallons)	24		24		24		24		264
Total - Normal Pump Cycle (90%-50%) (Gallons)	48		48		48		48		264
FTP-A - Failed Pump Run Out (50%-25%)									165

Transfer Pump	**FTP-A**	FTP-B
Rated Flow (GPM)	**20**	20
FTP-A - Normal Pump Cycle (90%-50%) (Gallons)	**96**	360
FTP-A - Failed Pump Run Out (50%-25%) (Gallons)		

Generator #	Generator #1		Generator #2		Generator #3		Generator #4		Generator #5	
Load Percentage	75%	100%	75%	100%	75%	100%	75%	100%	75%	100%
Fuel Consumption each (GPM)	0.9	1.2	0.9	1.2	1.4	1.7	1.4	1.7	1.8	2.3
Pump Off Cycle for Day Tank 90%-50% (Minutes)	52.9	39.9	52.9	39.9	35.1	27.5	35.1	27.5	147.3	114.8
Generator Run Time WITH NO PUMPS (90%-10%) (Minutes)	105.9	79.9	105.9	79.9	70.2	55.1	70.2	55.1	294.7	229.6
Generator Run Time WITH NO PUMPS (90%-10%) (Hours)	1.76	1.33	1.76	1.33	1.17	0.92	1.17	0.92	4.91	3.83
Generator Run Time After Low Alarm (25%-10%) (Minutes)	19.9	15.0	19.9	15.0	13.2	10.3	13.2	10.3	55.3	43.0
Generator Run Time After Low Alarm (25%-10%) (Hours)	0.33	0.25	0.33	0.25	0.22	0.17	0.22	0.17	0.92	0.72

	FTP-A		X-FOP-3	
Generator Running Load	**75%**	**100%**	75%	100%
Combined Fuel Consumption (All Generator Running) (GPM)	**2.3**	**2.9**	4.1	5.2
Pump Run Time Generator Running (Minutes)	**5.4**	**5.6**	22.6	24.4
Day Tank Fill Time (No Generator Running)(Minutes)	**4.8**	**4.8**	18.0	18.0
Pump Check Size (4 Times Engine Rate) (GPM)		**11.8**		**21.0**

FUEL OIL PUMP PIPING CONNECTION DETAIL

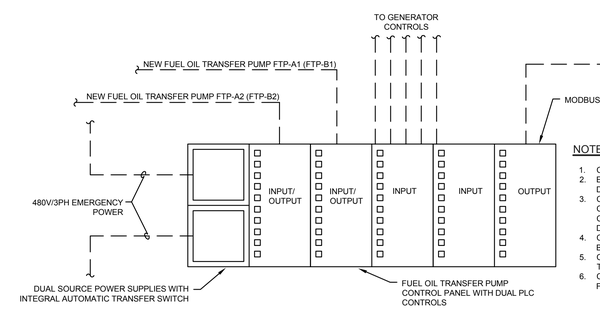


CONTROL PANEL
1. DISCONNECT FOR EACH PUMP MOTOR
2. MOTOR STARTER
3. H-O-A SWITCHES
4. DUAL MICROPROCESSOR PLC CONTROLLERS
5. WIRED FOR DUAL INDEPENDENT POWER SOURCES
6. INDICATOR LIGHTS
   6.1. PUMP 1 RUN
   6.2. PUMP 2 RUN
   6.3. PUMP FAIL
   6.4. PRIMARY POWER ON
   6.5. SECONDARY POWER ON
   6.6. PUMP 1 NOT IN AUTO
   6.7. PUMP 2 NOT IN AUTO
7. BMS COMMUNICATION
   7.1. STATUS
   7.2. ALARMS
   7.3. MODBUS COMMUNICATION CARD
8. ALARM SILENCE / SYSTEM RESET BUTTON
9. EMERGENCY SHUT OFF BUTTON
10. SELECTOR SWITCH PLC-A / PLC-B

NOTES:
1. ALL PIPE SHALL BE SCHEDULE 40 BLACK STEEL WITH MALLEABLE IRON FITTINGS PAINTED WITH ENAMEL.
2. BOTH MOTORS AND EACH CONTROL DEVICE SHALL BE FACTORY WIRED TO JUNCTION BOX.
3. FUEL OIL PUMP PACKAGES SHALL BE DESIGNED TO FIT INTO THE EXISTING BUILDING DOOR FRAMES. CONTRACTOR TO FIELD MEASURE DOOR FRAME SIZES AND COORDINATE WITH PUMP MANUFACTURER PRIOR TO PURCHASING EQUIPMENT. MANUFACTURER MAY FLANGE PIPING OF PUMP PACKAGE TO MEET THIS REQUIREMENT. IF SO CONTRACTOR MUST ASSEMBLE PUMP PACKAGE IN FIELD.

NOT TO SCALE

FUEL OIL CONTROL PANEL INPUT/OUTPUT DIAGRAM



NOTES:
1. CONTROL PANEL DETAIL TYPICAL FOR BOTH FTP-A AND FTP-B.
2. EACH FUEL OIL PUMP PACKAGE SHALL BE PROVIDED WITH A DUAL POWER SOURCE CONTROL PANEL.
3. CONTRACTOR SHALL TERMINATE, AND TEST ALL ALARMS AND CONTROL WIRING BETWEEN THE TWO NEW TRANSFER PUMP CONTROL PANELS, PROVIDE, EXISTING ALARM PANEL, EXISTING DAY TANK CONTROLS, AND EXISTING GENERATOR CONTROLS.
4. CONTRACTOR SHALL PROVIDE ALL REQUIRED CONTROL WIRING BETWEEN DEVICES.
5. CONTRACTOR SHALL TIE INTO TRANSFER PUMP CONTROL PANEL TO DISPLAY STATUS POINTS AND GENERATE ALARMS LISTED.
6. CONTROLS CONTRACTOR SHALL TIE INTO THE NEW GENERATOR FOR LISTED POINTS/ALARMS.

NOT TO SCALE

EXHAUST FAN

MARK	EF-100
STYLE	CENTRIFUGAL
TYPE	BACKWARD
PERFORMANCE	
AIR FLOW (CFM)	300
STATIC PRESSURE (IN W.G.)	0.25
FAN SPEED (RPM)	1725
NOISE LEVEL (db)	52
MOTOR	
TYPE OF DRIVE	DIRECT
MOTOR SIZE (HP)	0.25
VOLTS-PHASE-HERTZ	115-1-60
ACCESSORIES	
UNIT MOUNTED DISCONNECT	YES
ANTI-VIBRATION DAMPER	YES
BACKDRAFT DAMPER	YES

NOTE:
PROVIDE CENTRIFUGAL FAN WITH THE FOLLOWING; GRAY POLYPROPYLENE HOUSING, BACKWARD CURVED RADIAL IMPELLERS MADE OF POLYPROPYLENE, STAINLESS STEEL CONSOLES, AN EXPLOSION PROOF MOTOR AND AN EXPLOSION PROOF UNIT DISCONNECT. ORIENTATION OF THE CENTRIFUGAL FAN SHALL BE UP BLAST POSITION.

FUEL OIL PUMP PACKAGE SCHEDULE

MARK	LOCATION	SYSTEM	TYPE	PUMP BODY	CIRCULATING FLUID			TYPE	MOTOR (EACH)			
					FLUID	FUEL OIL GPM	PRESSURE DROP FT FLUID	TEMP. °F (°C)		NOMINAL HP	VOLTAGE PHASE	FULL LOAD AMPS	RPM
FTP-A	FUEL OIL STORAGE TANK VAULT	EMERGENCY GENERATORS	DUPLEX POSITIVE DISPLACEMENT	CAST IRON	NO. 2 FUEL OIL	20	50	80(27)	CLOSE COUPLED ROTERY GEAR	2	460-3	2.9	1800
FTP-B (2)	ROOM BD502	EMERGENCY GENERATORS	DUPLEX POSITIVE DISPLACEMENT	CAST IRON	NO. 2 FUEL OIL	20	50	80(27)	CLOSE COUPLED ROTERY GEAR	2	460-3	(2) 2.9	1800

1. BASIS OF SPECIFICATION: DUPLEX POSITIVE DISPLACEMENT PUMP PACKAGE WITH REDUNDANT PUMP CONTROLS.
2. REFER TO SPECIFICATIONS FOR REQUIRED ACCESSORIES.
3. PUMP MOTOR SHALL BE TEFC, INSULATION CLASS F, RATED FOR CONTINUOUS DUTY.
4. PROVIDE REDUNDANT CONTROLLER, INCLUDES CONTACTS, PLC AND MODBUS INTERFACE FOR TRANSMISSION OF PUMP RUN SIGNALS AND ALARM INDICATIONS. TRANSFER LOGIC OPERATION SHALL TRANSFER PUMP OPERATION WHEN NO FUEL FLOW IS SENSED VIA A REMOTE FLOW SWITCH AND THE EMERGENCY GENERATOR SET IS RUNNING.
5. PROVIDE DUAL POWER INLET, 460V-3Ø-60Hz, WITH POWER TRANSFER RELAY AND POWER AVAIALBLE/CONNECTED/FAIL INDICATORS AND AUTOMATIC SWITCH OVER.
6. PROVIDE PUMP STARTERS FOR EACH PUMP. NEMA 1 ENCLOSED, UNIT MOUNTED, HINGE-OPEN FRONT DOOR, FULL-VOLTAGE, 3-PHASE CIRCUIT BREAKER COMBINATION MOTOR STARTER, WITH CONTROL POWER TRANSFORMER, HOA SWITCH, RUN INDICATOR, POWER AVAILABLE INDICATOR.
7. ALL ALARMS SHALL BE COMMUNICATED WITH THE BMS VIA MODBUS COMMUNICATION.
8. THE CONTROL PANEL WILL SHOW THE FOLLOWING ALARMS ON THE LCD DISPLAY:
   A. PUMP 1 NOT IN AUTO
   B. PUMP 2 NOT IN AUTO
   C. PUMP FLOW FAILURE
   D. PUMP THERMAL OVERLOAD TRIP
   E. PUMP SET LEAK
   F. PUMP SET DIRTY STRAINER
   G. EMERGENCY STOP ACTIVATED
   H. PLC-A FAILURE (2)
   I. PLC-B FAILURE (2)
9. THE AUDIBLE ALARM SHALL TRIP WHEN ANY OF THE FOLLOWING ALARMS ARE PRESENT:
   A. PUMP FLOW FAILURE
   B. PUMP THERMAL OVERLOAD TRIP
   C. PUMP SET LEAK
   D. EMERGENCY STOP ACTIVATED (2)
10. SHIPPED PUMP PACKAGE ASSEMBLY FOR FTP-A MUST FIT THROUGH A DOOR OPENING 44" X 82" AND FOR FTP-B MUST FIT THROUGH A DOOR OPENING 32" X 82"

FULLY SPRINKLERED

Revisions:	Date
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ADDENDUM 01	09/01/16
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ARCHITECT:

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